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ATTACHMENT COVER PAGE

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METRIC

MIL-PRF-27401E

23 February 2007

SUPERSEDING

MIL-PRF-27401D

3 October 1995

PERFORMANCE SPECIFICATION

PROPELLANT PRESSURIZING AGENT, NITROGEN

This specification is approved for use by all Departments and Agencies of the Department of Defense.

Comments, suggestions, or questions on this document should be addressed to HQ-AFPET/AFTT, 2430 C Street, Bldg 70, Area B, Wright-Patterson AFB OH 45433-7632 or e-mailed to AFPET.AFTT@wpafb.af.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil>.

AMSC N/A

FSC 9135

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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1. SCOPE

1.1 Scope. This specification covers the requirements for three grades and two types of nitrogen.

1.2 Classification. The nitrogen will be of the following types and grades as specified (see 6.2).

1.2.1 Types. The types of nitrogen are as follows:

Type I - Gaseous

Type II - Liquid

1.2.2 Grades. The grades of nitrogen are as follows:

Grade A - 99.5 percent pure, aerospace practices

Grade B - 99.99 percent pure, space vehicle and cabin environment

Grade C - 99.995 percent pure, special applications

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specification forms a part of this document to the extent specified herein. Unless otherwise specified, the issue of this document is the one cited in the solicitation or contract (see 6.2).

COMMERCIAL ITEM DESCRIPTIONS

A-A-58092 Tape, Antiseize, Polytetrafluorethylene

(Copies of this document is available online at <http://assist.daps.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Bldg 4D, Philadelphia PA 19111-5094.)

2.3 Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL

ASTM E 29 Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

ASTM F 307 Standard Practice for Sampling Pressurized Gas for Gas Analysis

ASTM F 310 Standard Practice for Sampling Cryogenic Aerospace Fluids

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(Copies of these documents are available online at <http://www.astm.org> or by mail at ASTM International, 100 Barr Harbor Drive, West Conshohocken PA 19428-2959)

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-10.1	Commodity Specification for Nitrogen
CGA P-15	Filling of Industrial and Medical Nonflammable Compressed Gas Cylinders

(Copies of these documents are available online at <http://www.cganet.com> or by mail from the Compressed Gas Association, Inc., 4221 Walney Road, 5th floor, Chantilly, VA 20151-2923)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Grade requirements. The purity and impurity concentrations as applicable to each grade of nitrogen shall conform to the limits of Table I when tested in accordance with the applicable test method also specified in Table I. Other limits and tests may be specified by the procuring activity (see 6.2).

3.2 Limiting values. The following applies to all specified limits in this specification: For purposes of determining conformance with these requirements, an observed value or a calculated value shall be rounded off "to the nearest unit" in the last right-hand digit used in expressing the specification limit according to the rounding-off method of ASTM E 29 Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications.

3.3 Filter.

3.3.1 Containers. A filter with a rating of at least 10-micrometer nominal and 40-micrometer absolute rating shall be installed between the manufacturer's plant system and the manifold used to fill the gas or liquid containers for delivery.

3.3.2 Pipelines. A filter with a rating of at least 3.5-micrometer nominal and 12-micrometer absolute rating shall be installed downstream of compressors and/or converters and as close to the user's interface as possible for delivery into pipelines. The filter shall remove all particles greater than 100 micrometers in any dimension.

3.4 Filled containers (Type I only).

3.4.1 Pressure. The container filling pressure shall not differ from that required by the contract by more than 1% at 70°F when tested as specified in 4.5.1. Cylinders shall be filled to within 99 to 100 percent of their rated service pressure when tested as specified in 4.5.1. In no case shall the filling pressure exceed the rated service pressure of the container. Pressure-Temperature Filling Chart in CGA P-15 may be used.

3.4.2 Leakage. Containers shall not leak when tested according to 4.5.2.

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TABLE I. Grade limits for nitrogen.

	Grade			Test Method
	A	B	C	
Purity ^{a, b} , % by vol, min	99.5	99.99	99.995	4.4.1
Impurities, ppm by volume, max	5000	100	50	Note c
Water	26.3	11.5	5.7	4.4.2
Total hydrocarbons as methane	58.3	5.0	5.0	4.4.2
Oxygen	5000	50	20	4.4.2
Hydrogen	Note d	Note d	0.5	4.4.2
Argon ^e	Note d	20	2	4.4.2
Carbon dioxide ^e	Note d	5	5	4.4.2
Carbon monoxide ^e	Note d	5	5	4.4.2
Particulate ^f , mg/L, max	1.0	1.0	1.0	4.4.3
Notes. a. Percent nitrogen includes trace quantities of neon, helium, and argon. b. If direct method is required, use the alternate method found in 6.3. c. Sum, in parts per million (ppm), of water, hydrocarbons, oxygen, hydrogen, carbon monoxide, carbon dioxide, and argon. d. No limit for this grade. e. If required by contract (see 6.2). f. Applies only to Type II (Liquid) nitrogen. The particulate limit may be removed by the procuring activity (see 6.2).				

4. VERIFICATION

4.1 Points of inspection (see 6.2).

4.1.1 Containers. Unless otherwise specified, acceptance tests shall be conducted at the site of filling prior to shipment or departure.

4.1.2 Pipeline. When Type I nitrogen is delivered in pipeline, acceptance tests shall be conducted immediately prior to entering the user's system.

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4.2 Conformance inspection. Quality conformance tests shall consist of the following:

- a. Individual tests (Type I only)..... 4.2.1
- b. Sampling tests 4.2.2

4.2.1 Individual tests (Type I only). Each container shall be subjected to the following tests as described under 4.5:

- a. Filling pressure 4.5.1
- b. Leakage 4.5.2

4.2.2 Sampling test. The number of nitrogen containers shall be selected in accordance with Table II and subjected to the tests required by Table I.

TABLE II. Sampling for test.

Number of containers in lot	Number of containers to be sampled
1	1
2 – 40	2
41 – 70	3
71 – over	4

4.2.3 Lot definitions.

4.2.3.1 Type I. A lot is defined as all of the nitrogen supplied in one or more container(s) filled from a single manifold at the same time.

4.2.3.2 Type II. Each filled container shall constitute a lot.

4.2.3.3 Container Assemblies. A shipping conveyance consisting of multiple cylinders or tubes that are interconnected by a single manifold that equalizes the pressure across all cylinders/tubes to form a single unit is considered a single container for the purpose of this specification.

4.2.4 Sample. Each sample shall be of sufficient size to conduct all the quality conformance tests as specified herein. Unless otherwise specified, the quality conformance tests shall be performed on each required sample (see 6.2). When required, an equivalent sample shall be forwarded to a laboratory designated by the procuring activity for testing.

4.2.4.1 Sampling methods. Each sample taken for analysis shall be representative of the entire contents of the container being sampled. All equipment used shall be made of suitable materials. Unless otherwise specified in the acquisition requirements (see 6.2), sampling shall be accomplished by one of the following methods.

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a. Type I, gaseous nitrogen may be sampled in accordance with ASTM F 307 and Type II, liquid nitrogen may be sampled in accordance with ASTM F 310. It is critical that the outlet of the sampling port be clean and free of contaminants.

b. Connect the shipping container being sampled directly to the analytical equipment using suitable pressure regulation as required to prevent over-pressurization of the equipment.

4.2.5 Non-Bulk Containers. Non-bulk containers are defined as containers of 400 liters or less water capacity. The number of containers filled with Type I (gaseous) nitrogen selected for sampling from each lot shall be in accordance with Table II. The first and last containers to be filled within a given lot are typically sampled. Other samples may be selected at random. Every container filled with Type II (liquid) nitrogen shall constitute a lot and will be sampled.

4.2.6 Bulk transports. Bulk containers are defined as containers of more than 400 liters water capacity. Each bulk container filled with Type I (gaseous) or Type II (liquid) nitrogen constitute a lot and shall be sampled.

4.2.6.1 Continuous service (see 6.6.1). Unless otherwise specified by the procuring activity, the following sample option for nitrogen shall be used for storage and transport tanks engaged in continuous nitrogen service (see 6.2). Contractor shall sample the contents of each transport tank engaged in continuous nitrogen service at least once every seven days at uniform intervals of time. Samples shall be taken from the filled transport tanks. Contractor shall sample the contents of each transport tank when entering continuous service and when the transport tank has remained empty for a period greater than 24 hours. When empty, all ports and vents shall remain closed to the atmosphere. While in continuous service, compliance with quality conformance tests specified herein shall be determined by sampling the filling point storage tank after each addition or, in case of continuous production, at established intervals not less frequent than once every 24 hours. When a storage tank is being filled during a change of duty shift, sampling shall be performed after filling.

4.2.7 Pipelines. Unless otherwise specified in the contract, the following sampling plan shall be used for pipelines: Sampling to determine specification compliance shall be accomplished by drawing liquid phase samples from each filled container transporting liquid for conversion to gas and by drawing samples from the gas supplied into the user's system (see 6.2).

4.2.7.1 Liquid phase samples. Liquid phase samples shall be tested for each parameter in applicable grade of Type II nitrogen. Sampling under the "continuous service" provisions can be applied.

4.2.7.2 Gas phase samples.

a. Samples shall be tested for each parameter in the applicable grade of Type I nitrogen. Samples shall be drawn in accordance with 4.2.4 from a point immediately prior to entering the user's system. The frequency of sampling shall not be less than once every seven days at regular intervals.

b. When specified in contract, in-line samples shall be drawn and tested with continuous monitors for each parameter specified in contract for the applicable grade of Type I nitrogen. Each analyzer shall be equipped with a permanent recording device. When specified in contract, an alarm system to indicate contaminant contents in excess of specified maximum shall be provided (see 6.2).

c. After internal exposure of the pipeline to the atmosphere or other foreign materials, a sample of gas shall be taken from the pipeline prior to delivery into the user's system at a point between the final filter and the interface with the Government system. The sample shall be tested for each parameter in applicable grade of Type I nitrogen. After cleaning operation, the sample shall also be tested for contamination by vapors from the cleaning materials.

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4.3 Rejection. When any sample tested in accordance with 4.4 fails to conform to the requirements specified herein, the entire lot represented by the sample shall be rejected.

4.4 Analytical procedures. Unless otherwise specified, samples shall be analyzed according to the procedures described in 4.4.2 (see 6.2). Calibration gas standards may be required to calibrate (zero and span) analytical instruments used to determine the purity and impurity contents of the nitrogen. The accuracy of the calibration gas standards is to be traceable to the National Institute of Standards and Technology.

4.4.1 Nitrogen content. The nitrogen content in percent shall be found by determining the aggregate impurities by the methods described in 4.4.2. The aggregate impurities shall include all of the impurities listed in Table I regardless of grade. The nitrogen purity is the value obtained when the aggregate impurities, expressed as volume percent, is subtracted from 100 percent.

4.4.2 Impurities. Methods shall be selected from those of CGA G-10.1.

4.4.3 Particulate content. A filter holder assembly, (Pall Life Sciences part number 2220), or equivalent modified as shown in Figure 1 shall be attached to the withdrawal line of the vessel to be utilized to fill the tanks. A preweighed filter paper (47 mm glass fiber paper, type A/E or equivalent) shall be placed on top of another filter of the same kind. The filters shall then be placed on the porous filter support, which, in turn, shall be placed in the filter holder as shown in Figure 1. The male threads of the filter holder shall be wrapped with thin, nonadhesive-backed polytetrafluorethylene tape A-A-58092 or equivalent to prevent galling of the threads. The holder shall be tightened by hand as tight as possible to prevent bypassing of the filter element. The discharge liquid from the filter housing shall be collected in a clean, uninsulated, ambient temperature vessel marked to indicate when 5 liters of liquid have been collected. The liquid flow shall be terminated when 5 liters of liquid have been collected. The filter holder shall be removed from the line and permitted to reach ambient temperature. The warmup to ambient temperature may be expedited by use of an oven or other heat source. Care shall be exercised to ensure that any airflow which enters the unit will be directed through the inlet of the assembly to prevent displacing any particles from the surface of the filter. Upon warmup, the other side of the holder shall be wiped with a clean cloth and the holder then disassembled. The filter paper shall be closely inspected. The test shall be repeated if evidence of either (a) the filter not being securely clamped by uniform depression of its edge; (b) the filter having been cut by the holder; or (c) when dirt particles are detected in the clamped area indicating bypassing had been encountered. The test shall also be repeated when either the bottom filter shows any discoloration or when leakage of liquid from the filter holder is detected. Upon completion of a valid test the filter shall be removed from the housing and weighed to the nearest 0.1 mg.

4.5 Containers of Type I nitrogen.

4.5.1 Filling pressure. Containers shall be tested for proper filling pressure by attaching a calibrated Bourdon-tube gauge or equivalent to the valve outlet and by attaching either a thermocouple or thermometer to the container wall. The gauge shall have scale divisions not greater than 100 kPa (15 psi). If a thermometer is used, tape or putty shall be applied to the bulb to protect it from extraneous temperatures. Putty shall not be applied between the bulb and the container wall. The thermometer shall have scale divisions not greater than 1°C (2°F). The containers shall be stabilized to ambient temperature. Then the valve shall be opened and the internal pressure observed on the gauge

4.5.2 Leakage. Each Type I nitrogen container shall be tested for leaks at the neck threads, stem packing, and safety device of the valve with leak-detection fluid. Valve seat leakage shall be tested after filling has been completed by connecting a hose to the valve outlet and placing the other end of the hose under the surface of a liquid.

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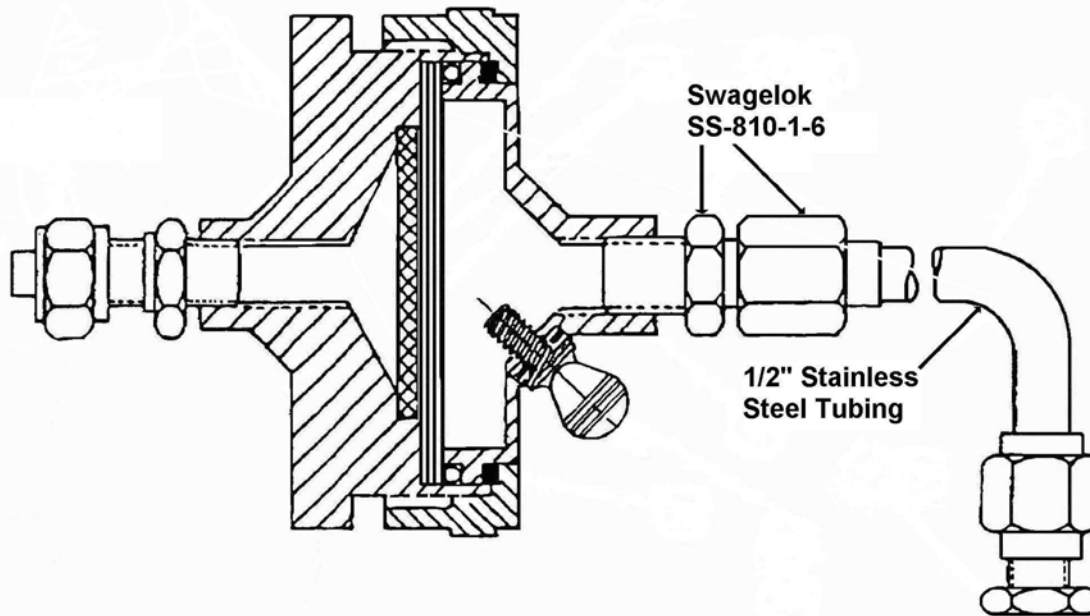


FIGURE 1. Filter, Cryogenic Liquids

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The nitrogen covered by this specification is intended as a purging and pressurizing medium for rocket propellant systems, space vehicles and support equipment and for preparing oxygen-nitrogen mixtures for breathing purposes on board space vehicles (see 1.2.2).

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6.2 Acquisition requirements. Acquisition documents must specify the following:

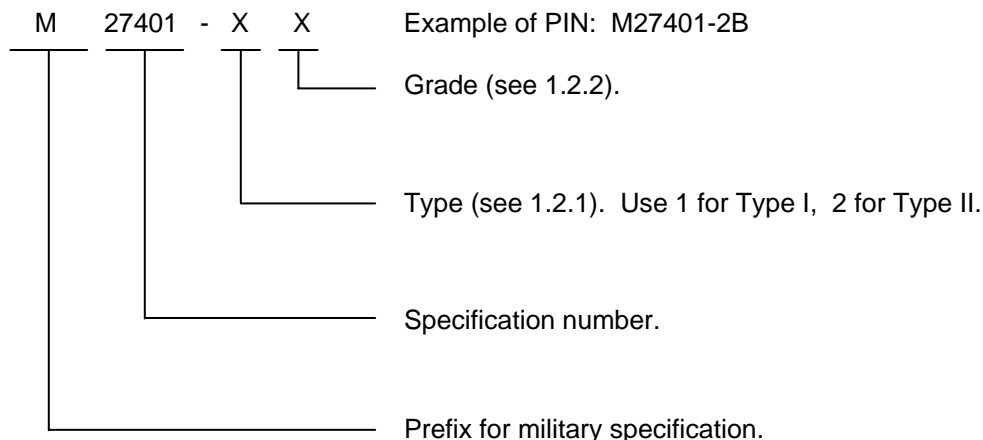
- a. Title, number, and date of this specification.
- b. Type and grade of nitrogen required (see 1.2).
- c. If required, the specific issue of individual documents referenced (see 2.2.1).
- d. When other limits or tests are required (see 3.1).
- e. When testing for argon, carbon dioxide, or carbon monoxide is required (see Table I, Note e).
- f. When the particulate test is not required (see Table I, Note f).
- g. When a variation in the points of inspection is required (see 4.1).
- h. When a variation of the quality conformance tests to be performed on a sample is required (see 4.2.4).
- i. When a variation to the sampling method is required (see 4.2.4.1).
- j. When a variation to the continuous service option is required (see 4.2.6.1).
- k. When a variation to the sampling plan for pipelines is required (see 4.2.7).
- l. When an alarm system to warn of contaminants in pipelines is required (see 4.2.7.2.b).
- m. When a variation of the analytical procedures is required (see 4.4).
- n. Packaging requirements (see 5.1).
- o. When color coding of pipeline is required (see 6.4.c).

6.3 Direct nitrogen method. When required one of the following methods shall be used to determine the nitrogen content directly. (1) The gas chromatographic method which uses a 5Å molecular sieve column and measures the peak height versus retention time. (2) The mass spectrometric method which measures nitrogen at an atomic mass unit (amu) of 28. Carbon monoxide also has an amu of 28 but it can be determined by other methods.

6.4 Packaging requirements. Guidance for cylinders may be found in the following documents:

- | | |
|---------------------|---|
| a. RR-C-901 | Cylinders, Compressed Gas: Seamless Shatterproof, High Pressure DOT 3AA Steel, and 3AL Aluminum |
| b. MIL-DTL-2/11 | Valve, Cylinder, Gas, Argon, Helium, Nitrogen, Neon, and Xenon, (Inert-Oil Free), Outlet 580 |
| c. MIL-STD-101 | Color Code for Pipelines and for Compressed Gas Cylinders |
| d. MIL-STD-1411 | Inspection and Maintenance of Compressed Gas Cylinders |
| e. 49 CFR 171 – 199 | Code of Federal Regulations |

6.5 Part or identifying number. The PINs to be used for nitrogen acquired to this specification are created as follows:



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6.6 Definition.

6.6.1 Continuous service. Continuous service applies to continuous deliveries under Government contract of nitrogen complying with the quality conformance tests specified herein.

6.7 Subject term (key word) listing.

Aerospace
Cryogenic
Cylinders
Pipeline
Space vehicle

6.8 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:

Army – MI
Navy – AS
Air Force – 68
DLA – PS

Preparing activity:

Air Force – 68
(Project 9135-2005-004)

Review activities:

Air Force – 19
Air Force – 11

Civil Agency:

NASA – NA

Note: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information using the ASSIST Online database at <http://assist.daps.dla.mil>.

INCH-POUND

MIL-PRF-27210G
4 April 1997
SUPERSEDING
MIL-O-27210F
1 August 1990

PERFORMANCE SPECIFICATION

OXYGEN, AVIATOR'S BREATHING, LIQUID AND GAS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements for two types of aviator's breathing oxygen.

1.2 Classification. The oxygen shall be of the following types as specified (6.2):

1.2.1 Types. The types of oxygen are as follows:

Type I - Gaseous

Type II - Liquid

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to SA-ALC/SFSP, 1014 Billy Mitchell Blvd/STE 1, Kelly AFB TX 78241-5603, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 6830

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

SPECIFICATIONS

DEPARTMENT OF DEFENSE

MIL-S-27626

- Sampler, Cryogenic Liquid

(Unless otherwise indicated, copies of the above specifications are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia PA 19111-5094).

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM E 29 - Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- ASTM F 307 - Practice for Sampling Pressurized Gas for Gas Analysis
- ASTM F 310 - Practice for Sampling Cryogenic Aerospace Fluids

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia PA 19103-1187.)

COMPRESSED GAS ASSOCIATION (CGA)

- CGA G-4.3 - Commodity Specification for Oxygen
- CGA P-15 - Filling of Industrial and Medical Nonflammable Compressed Gas Cylinders

(Application for copies should be addressed to the Compressed Gas Association, Inc, 1725 Jefferson Davis Highway, Arlington VA 22202-4100.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Preproduction and periodic inspection. Preproduction and periodic inspection shall be performed as specified in 4.2.

3.2 Purity.

3.2.1 Type I. Gaseous oxygen shall contain not less than 99.5 percent oxygen by volume when tested in accordance with 4.6. The remainder, except for moisture and minor constituents specified in Table I, shall be argon and nitrogen.

3.2.2 Type II. Liquid oxygen shall contain not less than 99.5 percent oxygen by volume when gasified and tested in accordance with 4.6. The remainder, except for moisture and minor constituents specified in Table I, shall be argon and nitrogen.

3.3 Impurities. The oxygen shall be free from all contaminants of known toxicity to the maximum practicable extent. Limitations on specific impurities shall be as follows:

3.3.1 Odor.

3.3.1.1 Type I. Type I oxygen shall contain no odor when tested as specified in 4.6.

3.3.1.2 Type II. Type II oxygen shall contain no odor when tested as specified in 4.6.

3.3.2 Minor constituents. Minor constituents of Types I and II shall not exceed the quantity specified in Table I.

3.3.3 Moisture. Moisture in Types I and II shall not exceed 7 ppm of water vapor or a maximum dew point of -82°F when tested as specified in 4.6.

TABLE I. Constituent concentrations.

Constituent	Maximum concentration in parts per million (by volume)	
	Type I	Type II
Carbon dioxide (CO ₂)	10	5
Methane (CH ₄)	50	25
Acetylene (C ₂ H ₂)	0.1	0.05
Ethylene (C ₂ H ₄)	0.4	0.2
Ethane (C ₂ H ₆) and other hydrocarbons as ethane equivalents	6	3
Nitrous oxide (N ₂ O)	4	2
Halogenated compounds		
Refrigerants	2	1
Solvents	0.2	0.1
Other (each discernible from background noise on infrared spectrophotometer)	0.2	0.1

3.4 Materials. There is no requirement included herein which should be interpreted to exclude the use of reclaimed materials in the manufacture of this commodity.

3.5 Filter. Type II oxygen shall be filtered through a 10-micrometer nominal (40-micrometer absolute) filter located in the fill line to the shipping container.

3.6 Limiting values. The following applies to all specified limits in this specification: For purposes of determining conformance with these requirements, an observed value or a calculated value shall be rounded off "to the nearest unit" in the last right-hand digit used in expressing the specification limit according to the rounding-off method of ASTM Practice E 29 for Using Significant Digits in Test Data to Determine Conformance with Specifications.

3.7 Filled containers (Type I only).

3.7.1 Pressure. Cylinders and tubes shall be within 99 to 100 percent of rated service pressure when tested as specified in 4.5.1. Pressure-Temperature Filling Charts in CGA P-15 may be used.

3.7.2 Leakage. Cylinders shall not leak when tested according to 4.5.2.

4. VERIFICATION

4.1 Classification of inspections. The inspections specified herein are classified as follows:

- a. Preproduction inspection (see 4.2).
- b. Periodic inspection (see 4.2).
- c. Quality Conformance inspection (see 4.3).

4.2 Preproduction and periodic inspections.

4.2.1 Preproduction inspection. Prior to initial delivery of Type I or Type II oxygen, a representative product specimen shall be selected as specified in 4.2.3.1 (Type I) or 4.2.3.2 (Type II) and forwarded to the laboratory designated in the contract or order (6.2). The product shall meet the requirements in 3.2 and 3.3.

4.2.2 Periodic inspection. A representative product specimen of oxygen shall be selected as specified in 4.2.3.1 (Type I) or 4.2.3.2 (Type II) and shall be taken once every 45 calendar days for the duration of the contract. This sample shall be shipped to the laboratory specified in the contract (6.2) for testing to determine compliance with requirements specified in Table I. The specified laboratory shall also test for purity and moisture if there is sufficient sample. The purity and moisture results shall be reported for correlation purposes and shall not be used to determine compliance to requirements of 3.2 or 3.3.3.

4.2.3 Sampling point.

4.2.3.1 Type I oxygen. Samples shall be taken from the manifold during filling operations.

4.2.3.2 Type II oxygen. Samples shall be taken from Type II oxygen storage tanks at the manufacturing site or any distribution facilities. If a

distribution facility is supplied from more than one storage or manufacturing facility, each facility shall be checked as specified above.

4.3 Quality conformance inspection. Quality conformance inspection shall consist of the following:

- a. Individual inspection (see 4.3.2).
- b. Sampling inspection (see 4.3.3).

4.3.1 Place of inspection (see 6.2).

4.3.1.1 Type I oxygen. Quality conformance inspection on cylinders filled with Type I oxygen shall be performed at the site of filling (see 6.2).

4.3.1.2 Type II oxygen. Quality conformance inspection shall be performed on samples taken from Type II oxygen transport container prior to leaving the site of filling. The transport container shall not be permitted to take on further liquid oxygen between inspection at the filling point and arrival at its destination, unless all quality conformance inspections are performed on the contents after such filling.

4.3.2 Individual inspection. Each cylinder filled with Type I oxygen and the contents of each filled container of Type II oxygen shall be subjected to tests as follows:

TEST	TYPE I	TYPE II
Leak test	4.5.2	---
Odor test	---	4.6
Purity test	---	4.6
Moisture test	---	4.6

4.3.2.1 Type II individual inspection. After filling the shipping container, two product specimens shall be drawn from each container. One specimen shall be in liquid state and subjected to the odor test specified in 4.6. The other specimen shall be vaporized and subjected to the purity and moisture tests also specified in 4.6.

TABLE II. Sampling for test

Number of containers in lot	Number of containers to be sampled
1	1
2 - 40	2
41 - 70	3
71 - over	4

4.3.3 Sampling inspection. Randomly selected samples of Type I oxygen as specified in Table II shall be subjected to the following inspection:

Odor test	4.6
Fill pressure	4.5.1

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Purity	4.6
Moisture	4.6

The fill pressure test shall be performed prior to the odor, purity, and moisture tests. The cylinder pressure shall be checked after completion of all tests. If the sample cylinder pressure is then found to be below the minimum acceptable value, the cylinder shall be filled to within the acceptable range.

4.3.3.1 Lot definition. Each set of Type I oxygen cylinders filled on the same manifold at the same time shall constitute a lot.

4.3.4 Samplers. The sampler for Type I oxygen shall be a DOT approved cylinder with a water volume of about one liter and rated at about 1800 psig. The sampler for Type II oxygen shall be in accordance with MIL-S-27626 or functionally equivalent thereto. Only liquid samplers that convert the entrapped liquid to gas shall be used. The aliquots taken for analysis are representative samples.

TABLE III. Sampling particulars.

Sampler	Oxygen type	Method	Recommended final pressure
≈1-liter size	I	ASTM F 307	≈1800 psig
TTU-131/E	II	ASTM F 310	400 to 500 psig
P/N 600646	II	Manufacturer's instructions	1300 to 1800 psig

4.3.4.1 Sampling. Unless otherwise specified (see 6.2), oxygen shall be sampled according to the methods of Table III. Sample size shall be sufficient to provide the analyzer with 7 liters of oxygen at 10 atmospheres of pressure.

4.3.4.1.1 Exceptions for ASTM F 310. Replace paragraph 5.1 with "5.1 Ensure that the outlet of the sampling port is clean." Replace paragraph 6.1 with "6.1 Ensure that the outlet of the sampling port is clean."

4.3.4.2 Sample Identification. The following data shall be provided on each sample sent to a Government laboratory for analysis: Item name, specification number, Type (I or II), sample number, sampler serial number, contractor's name, address, phone number and return shipping address for sampler, Government representative's name, address, and phone number, reason for analysis (preproduction, periodic or resample), contract number, and date sample taken.

4.4 Rejection. When any sample of the oxygen fails to conform to the requirements specified herein, the entire lot represented by the sample shall be rejected. Disposition of the rejected product shall be specified by the procuring activity (see 6.2).

4.5 Containers of Type I oxygen.

4.5.1 Filling pressure. Samples shall be tested for proper filling pressure by attaching a calibrated Bourdon-tube gauge or equivalent to the valve outlet and by attaching either a thermocouple or thermometer to the container wall. The gauge shall have scale divisions not greater than 100 kPa (15 psi). If a thermometer is used, tape or putty shall be applied to the bulb to protect it from extraneous temperatures. Putty shall not be applied between the bulb and the cylinder wall. The thermometer shall have scale divisions not greater than 1°C (2°F). The containers shall be stabilized to ambient temperature. Then the valve shall be opened and the internal pressure observed on the gauge.

4.5.2 Leakage. Each Type I oxygen container shall be tested for leaks at the neck threads, stem packing, and safety device of the valve with leak-detection fluid. Valve seat leakage shall be tested by means of a tube from the valve outlet to a container of liquid.

4.6 Analytical procedures. Unless otherwise specified, samples shall be analyzed according to the procedures described in CGA G-4.3 (6.2). Calibration gas standards may be required to calibrate (zero and span) analytical instruments used to determine the purity and impurity contents of the oxygen. The accuracy of the calibration gas standards is to be traceable to the National Institute of Standards and Technology.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful but is not mandatory.)

6.1 Intended use. The oxygen covered by this specification is intended for use in aircraft breathing oxygen systems.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, type and date of this specification.
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).
- c. The name and address of the laboratory to which the representative product specimen is to be submitted (see 4.2, 6.8, and Table A-1).

- d. When variation in points of inspection are granted (see 4.3.1).
- e. When variation in sampling method is granted (see 4.3.4.1).
- f. Disposition of rejected product (see 4.4).
- g. When a variation in analytical procedures is granted (see 4.6).
- h. Packaging requirements (see 5.1 and A.3.1.6).
- i. When cleaning and repair schedule is required for leased or Government owned containers (see A.3.2).
- j. Instructions for disposition of rejected cylinders (see A.3.2).

6.3 Subject term (key word) listing.

Code, Color
Contaminant
Cryogenic
Cylinder
Filling pressure
Solvent
Infrared spectroscopy
Valve

6.4 International standardization agreements. Certain provisions of this specification are the subject of international standardization agreements ASCC STD 14/9, NATO STANAG 3053, and NATO STANAG 7046. When amendment, revision, or cancellation of this specification is proposed which will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels, including departmental standardization offices, to change the agreement or make other appropriate accommodations.

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

6.6 Containers. As of the date of this specification, the following listed containers are considered acceptable for military use and approved for oxygen as specified by DOT:

6.6.1 Type I (Gaseous).

6.6.1.1 Cylinders of specifications DOT 3A, 3AA, 3AAX and 3E1800.

6.6.2 Samplers.

6.6.2.1 The sampler TTU-131/E for Type II oxygen identified in Table III is shipped in accordance with Department of Transportation exemption DOT-E 3004.

6.6.3.2 Samplers should be suitably packaged to protect them during shipment. Packagings should be inspected and those with large amounts of wear

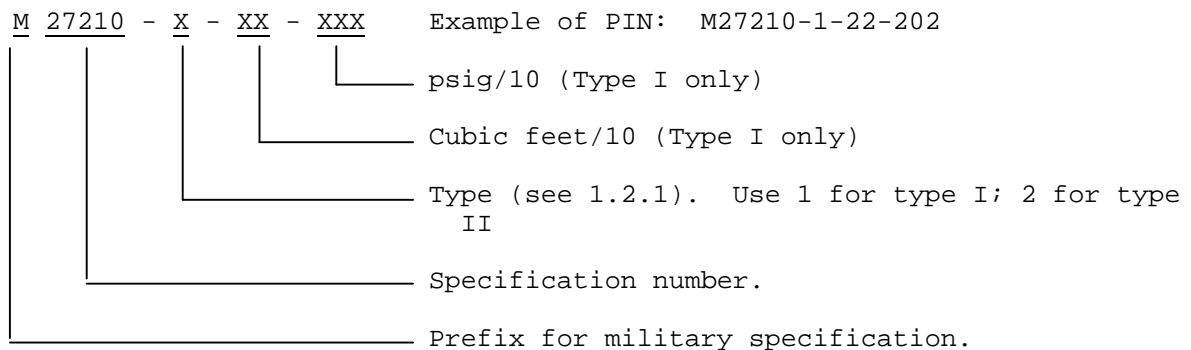
or damage should be replaced to ensure prompt shipment to and from the laboratory.

6.7 Price of services for Government-owned cylinders. The bidder's price for the gas should include the furnishing, at no additional cost, of all services which are required at each and every filling of a cylinder to comply with applicable regulations, specifications, and normal good practices. Such services shall include, but not be limited to inspection, testing, evacuation, and cleaning, and attaching Government-furnished warning tags, when required.

6.8 Government laboratories. Laboratories perform tests on preproduction and periodic samples using the procedures in MIL-STD-1564. These laboratories also participate in the Air Force Aviator's Breathing Oxygen Correlation Program. Contracting officers may obtain a list of approved Government laboratories by contacting San Antonio ALC/SFTT, 1014 Billy Mitchell Blvd/STE 1, Kelly AFB TX 78241-5603. See Table A-1.

6.9 Particulate contamination. Particulate matter may be introduced and accumulate during transfer and storage of oxygen. Recommend that users control particulate matter by the installation of filters in oxygen transfer lines.

6.10 Part or identifying number (PIN). The PINs to be used for oxygen acquired to this specification are created as follows:



6.11 Compatibility of Materials. AEP-33, *Guide to Methods of Test for Compatibility of All Materials Used in Oxygen Rich Environments*, may be used as a reference manual for guidance to improve methods of test for compatibility of all materials used in oxygen rich environments.

Custodians:
Navy - AS
Air Force - 68

Preparing Activity:
Air Force - 68

(Project 6830-1022)

Review activities:
DLA - GS

Civil Agencies Coordinating Activities:
NASA - JFK

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APPENDIX A

GUIDANCE FOR THE PREPARATION OF ACQUISITION DOCUMENTS

A.1 SCOPE

A.1.1 This appendix provides guidance to ensure that all the requirements of this specification are implemented by acquisition documents and applies to all Departments and Agencies of the Department of Defense. This appendix is not a mandatory part of the specification. The information contained herein is intended for guidance only.

A.2 APPLICABLE DOCUMENTS

- ANSI-Z540.1 - Laboratories, Calibration, and Measuring and Test Equipment
- ISO 10012-1 - Equipment, Metrological Confirmation System for Measuring
- MIL-DTL-2 - Valves, Cylinder, Gas (for Compressed or Liquefied Gases), General Specification For
- MIL-STD-101 - Color Code for Pipelines and for Compressed Gas Cylinders
- MIL-STD-1411 - Inspection and Maintenance of Compressed Gas Cylinders

A.3 PROVISIONS

A.3.1 In order to ensure that aviator's breathing oxygen conforms to this specification and meets the requirements for aircraft life support systems, the following clauses should be tailored for inclusion in acquisition documents:

A.3.1.1 Quality assurance. The contractor is responsible for the performance of all inspection requirements (examination and tests) required by the contract including specification MIL-PRF-27210. Facilities suitable for the performance of the inspections shall be used. The Government reserves the right to perform any of the inspections where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

A.3.1.2 Inspection at source. In CONUS and where available in overseas areas, inspection shall be performed by the Defense Contract Management Command (DCMC) at the filling plant and/or the place of service performance. The ordering activity shall forward a copy of the delivery order on liquid and gaseous aviator's breathing oxygen to the applicable DCMC inspection office at the time of issuance to the contractor.

A.3.1.3 Acceptance. Government inspection shall be performed at source. Final inspection and acceptance shall be performed at destination.

A.3.1.4 Inspection and calibration procedures. The contractor shall have written procedures for the following:

- a. Inspection of shipping containers for cleanliness and suitability.
- b. Sampling and testing of product from shipping containers.

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APPENDIX A

c. Handling, packing, marking, and shipping of containers.

The contractor shall calibrate test equipment in accordance with ANSI/NCSL Z540-1 or ISO 10012-1.

A.3.1.5 Sampling. Samples required by paragraphs 4.2.1 and 4.2.2 of MIL-PRF-27210 shall be delivered at the expense of the contractor to one of the laboratories listed in Table A-1 or other laboratories authorized by SA-ALC/SFTT, 1014 Billy Mitchell Blvd/STE 1, Kelly AFB TX 78241-5603.

A.3.1.6 Cylinders. Compressed gas cylinders shall be inspected, maintained and charged according to MIL-STD-1411.

A.3.1.6.1 Valves. Valves shall conform to MIL-DTL-2.

A.3.1.6.2 Color Coding. Government-owned cylinders shall be color coded according to MIL-STD-101.

A.3.1.7 Identification tag. An identification tag impervious to climatic conditions shall be wired to the outlet port of each container and shall contain the following information: Product name, specification number with revision letter, type designation, National Stock Number (NSN), quantity, name of manufacturer, name of contractor (if different from manufacturer), date of manufacture, and lot identification number.

A.3.1.8 Test reports. Test reports shall accompany each shipment and may be provided on the contractor's internal form, a letter of transmittal, or the product DD Form 250. For type I, the reports shall include the values obtained from the odor, fill pressure, purity and moisture tests. For type II, the reports shall include the values obtained from the odor, purity, and moisture tests.

A.3.2 Other provisions should be considered to include the following:

- a. Method of shipment.
- b. Type and capacity of container.
- c. A cleaning and repair schedule for cylinders
- d. Instructions for disposition of rejected cylinders.

TABLE A-1. Laboratories.

CALIFORNIA	SM-ALC/TIELB Attn: Gas Lab Bldg 368 4920 46th Lt McClellan AFB CA 95652-1346	MAINE	Aerospace Fuels Laboratory Det 20, SA-ALC/SFTLB - Bldg 14 Trundy Rd Searsport ME 04974-0408
	Aerospace Fuels Laboratory OL SA-ALC/SFTLE - Bldg 7422 1509 New Mexico Vandenberg AFB CA 93437-5315	NEW MEXICO	Aerospace Fuels Laboratory OL SA-ALC/SFTLI - Bldg 837 Holloman AFB NM 88330-7929
FLORIDA	Aerospace Fuels Laboratory OL SA-ALC/SFTLH - Bldg 54800 15251 Scrub Jay Street Cape Canaveral AFS FL 32920	NORTH CAROLINA	NAD MCAS Materials Analysis Lab Code 343 Bldg 4032 Cherry Point NC 28533-5030
	Naval Aviation Depot NAS Materials Engineering Lab Code 342, Bldg 793 Jacksonville FL 32212	OHIO	Aerospace Fuels Laboratory Det 13, SA-ALC/SFTLA - Bldg 70 2430 C St, Suite 1 Wright-Patterson AFB OH 45433-7632
	Aerospace Fuels Laboratory Det 21, SA-ALC/SFTLC - Bldg 1121 5311 North Boundary Blvd MacDill AFB FL 33621-5005	UNITED KINGDOM (RAF Mildenhall)	Aerospace Fuels Laboratory OL SA-ALC/SFTLF - Bldg 725 Mildenhall UK APO AE 09459
HAWAII	Commanding Officer NAS Barbers Point Fuel Div, Code 194 Barbers Point HI 96862-5050	VIRGINIA	Midatlantic Regional Matl's Test Lab 1126 Pocahontas St Code 134.14 Bldg V-61 Norfolk VA 23511-2195
ITALY (Aviano AB)	Aerospace Fuels Laboratory OL SA-ALC/SFTLJ - Bldg 505 Unit 6106 APO AE 09601-6106	WASHINGTON	Aerospace Fuels Laboratory Det 35, SA-ALC/SFTLD - Bldg 1 10 Park Ave C Mukilteo WA 98275-1618
JAPAN (Kadena AB)	Aerospace Fuels Laboratory Det 44, SA-ALC/SFTLG Unit 5161 APO AP 96368-5161		

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-PRF-27210 G

2. DOCUMENT DATE (YYMMDD)
970404

3. DOCUMENT TITLE : OXYGEN AVIATOR'S BREATHING, LIQUID AND GAS

4. NATURE OF CHANGE Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)
(1) Commercial
(2) AUTOVON
(if applicable)

7. DATE SUBMITTED
(YYMMDD)

8. PREPARING ACTIVITY

a. NAME
SA-ALC/SFSP

b. TELEPHONE Include Area Code)
(1) Commercial (2) AUTOVON
(210) 925-7847 945-7847

c. ADDRESS (Include Zip Code)
1014 BILLY MITCHELL BLVD, STE 1
KELLY AFB, TX 78241-5603

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:
DEFENSE QUALITY AND STANDARDIZATION OFFICE
5203 Leesburg Pike, Suite 1403, Falls Church, VA 22401-3466
Telephone (703) 756-2340 AUTOVON 289-2340

METRIC

MIL-PRF-25508G
21 November 2006

SUPERSEDING
MIL-PRF-25508F
19 October 1995

PERFORMANCE SPECIFICATION

PROPELLANT, OXYGEN

This specification is approved for use by all Departments and Agencies of the Department of Defense.

Comments, suggestions, or questions on this document should be addressed to DET 3, WR-ALC/AFTT, 2430 C Street, Bldg 70, Area B, Wright-Patterson AFB OH 45433-7632 or e-mailed to AFPET.AFTT@wpafb.af.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil>.

AMSC N/A

FSC 9135

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

MIL-PRF-25508G

1. SCOPE

1.1 Scope. This specification covers the requirements for three grades and two types of oxygen.

1.2 Classification. The oxygen shall be of the following types and grades as specified (see 6.2).

1.2.1 Types. The types of oxygen are as follows:

Type I – Gaseous

Type II – Liquid

1.2.2 Grades. The grades of oxygen are as follows:

Grade A – 99.6 percent pure, standard

Grade B – 99.5 percent pure, reduced standard

Grade F – 99.990 percent pure, fuel cell and breathing

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following standard forms a part of this document to the extent specified herein. Unless otherwise specified, the issues of this document are those cited in the solicitation or contract (see 6.2).

COMMERCIAL ITEM DESCRIPTION

A-A-58092 Tape, Antiseize, Polytetrafluorethylene

(Copies of this document is available online at <http://assist.daps.dla.mil/quicksearch/> or <http://assist.daps.dla.mil> or by mail from the Standardization Document Order Desk, 700 Robbins Avenue, Bldg 4D, Philadelphia PA 19111-5094.)

2.3 Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

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ASTM INTERNATIONAL (ASTM)

ASTM E 29	Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
ASTM F 307	Standard Practice for Sampling Pressurized Gas for Gas Analysis
ASTM F 310	Standard Practice for Sampling Cryogenic Aerospace Fluids

(Copies of these documents are available online at <http://www.astm.org> or by mail from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA, 19428-2959)

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-4.3	Commodity Specification for Oxygen
CGA P-15	Filling of Industrial and Medical Nonflammable Compressed Gas Cylinders

(Copies of these documents are available online at <http://www.cganet.com> or by mail from the Compressed Gas Association, Inc., 4221 Walney Road, 5th floor, Chantilly, VA 20151-2923)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Grade requirements. The purity and impurity concentrations as applicable to each grade of oxygen shall conform to the limits of Table I when tested in accordance with the applicable test method also specified in Table I. Other limits and tests may be specified by the procuring activity (see 6.2).

3.2 Limiting values. The following applies to all specified limits in this specification. For purposes of determining conformance with these requirements, an observed value or a calculated value shall be rounded off "to the nearest unit" in the last right-hand digit used in expressing the specification limit according to the rounding-off method of ASTM E 29 Standard Practice for using Significant Digits in Test Data to Determine Conformance with Specifications.

3.3 Filter. A filter with no more than a 10-micrometer nominal and 40-micrometer absolute rating shall be installed between the manufacturer's plant system and the manifold used to fill the gas or liquid containers for delivery.

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TABLE I. Grade limits for oxygen.

	Grade			Test Method
	A	B	F	
Purity, percent by volume, min	99.6	99.5	99.990	4.4.1
Impurities, ppm by volume, max	4000	5000	100	4.4.1
Total hydrocarbons as methane	50	67.7	20	4.4.2
Water	3	26.3	3	4.4.2
Methane	Note a	Note a	16	4.4.2
Ethane	Note a	Note a	2	4.4.2
Propane and higher hydrocarbons as propane	Note a	Note a	1	4.4.2
Nitrous oxide	Note a	Note a	1	4.4.2
Halogenated hydrocarbons	Note a	Note a	1	4.4.2
Carbon monoxide and carbon dioxide	Note a	Note a	1	4.4.2
Other (N, Ar, Kr, etc.)	Note a	Note a	75	4.4.2
Odor	Note a	Note a	None	4.4.2
Particulate ^b , mg/L, max	1.0	1.0	1.0	4.4.3
a. No limit for this grade. b. Applies to Type II product only. The particulate test requirement and limit may be deleted by the procuring activity (see 6.2).				

3.4 Filled containers (Type I only).

3.4.1 Filling Pressure. The container filling pressure shall not differ from that required by the contract by more than 1.0% at 70°F when tested as specified in 4.5.1. In no case shall the filling pressure exceed the rated service pressure of the container. Pressure-Temperature Filling Charts in CGA P-15 may be used.

3.4.2 Leakage. Cylinders shall not leak when tested according to 4.5.2.

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4. VERIFICATION

4.1 Points of inspection (see 6.2). Unless otherwise specified, acceptance tests shall be conducted at the site of filling prior to shipment or departure.

4.2 Conformance inspection. Quality conformance tests shall consist of the following:

- a. Individual tests (Type I only) 4.2.1
- b. Sampling tests 4.2.2

4.2.1 Individual tests (Type I only). Each container (cylinder or tube) shall be subjected to the following tests as described under 4.5.

- a. Filling pressure 4.5.1
- b. Leakage 4.5.2

4.2.2 Sampling test. The number of oxygen containers shall be selected in accordance with Table II and subjected to the tests required by Table I.

Table II. Sampling for test.

Number of containers in lot	Number of containers to be sampled
1	1
2 – 40	2
41 – 70	3
71 – over	4

4.2.3 Lot and Container Definitions

4.2.3.1 Lot: A lot shall be defined as one of the following

- a. All of the oxygen supplied in one or more containers filled from one manifold at the same time.
- b. All of the oxygen filled from a single storage tank that is homogenous at the time of withdrawal and is not added to while being withdrawn. After each addition to the storage tank, the contents shall constitute a separate lot.

4.2.3.2 Container: A container is defined as a shipping conveyance consisting of one cylinder or tube, or multiple cylinders or tubes that are interconnected by a single manifold that equalizes the pressure across all the cylinders or tubes to form one unit.

4.2.4 Sample. Each sample shall be of sufficient size to conduct all the quality conformance tests as specified herein. Unless otherwise specified, the quality conformance tests shall be performed on each required sample (see 6.2). When required, an equivalent sample shall be forwarded to a laboratory designated by the procuring activity for testing.

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4.2.4.1 Sampling methods. All apparatus used shall be made of suitable materials. Each sample taken for analysis shall be representative of the entire contents of the container being sampled. Unless otherwise specified in the acquisition requirements (see 6.2), sampling may be accomplished by the following methods.

a. Type I, gaseous oxygen may be sampled in accordance with ASTM F 307, for Type II, liquid oxygen may be sampled in accordance with ASTM F 310. It is critical that the outlet of the sampling port and the other equipment used in this process meet oxygen system cleanliness standards. Use an oxygen compatible cleaning solvent in accordance with local procedures for oxygen cleanliness.

b. By connecting the shipping container being sampled directly to the analytical equipment using suitable pressure regulation as required. It is critical that the outlet of the sampling port and the other equipment used in this process meet oxygen system cleanliness standards. Use an oxygen compatible cleaning solvent in accordance with local procedures for oxygen cleanliness.

4.2.5 Non-bulk Containers. Non bulk containers are defined as containers with a water capacity of 400 liters, or less. The number of non-bulk containers Type I (gaseous) or Type II (liquid) oxygen will be in accordance with Table II. Containers to be sampled may be selected at random.

4.2.6 Bulk Containers. Bulk containers are defined as having a water capacity in excess of 400 liters. Each bulk container filled with Type I (gaseous) and Type II (liquid) oxygen constitutes a lot and shall be sampled.

4.2.6.1 Continuous service. (see 6.4.1) Unless otherwise specified by the procuring activity, the following sample option for oxygen shall be used for storage and transport tanks engaged in continuous oxygen service (see 6.2). Contractor shall sample the contents of each transport tank engaged in continuous oxygen service at least once every seven days at uniform intervals of time. Samples shall be taken from the filled transport tanks. Contractor shall sample the contents of each transport tank when entering continuous service and when the transport tank has remained empty for a period greater than 24 hours. When empty, all ports and vents shall remain closed to the atmosphere. While in continuous service, compliance with quality conformance tests specified herein shall be determined by sampling the filling point storage tank after each addition or, in case of continuous production, at established intervals not less frequent than once every 24 hours. When a storage tank is being filled during a change of duty shift, sampling shall be performed after filling.

4.3 Rejection. When any sample tested in accordance with 4.4 fails to conform to the requirements specified herein, the entire lot represented by the sample shall be rejected.

4.4 Analytical procedures. Unless otherwise specified, samples shall be analyzed according to the procedures described below (see 6.2). Calibration gas standards may be required to calibrate (zero and span) analytical instruments used to determine the purity and impurity contents of the oxygen. The accuracy of the calibration gas standards is to be traceable to the National Institute of Standards and Technology (NIST). A suggested procedure for infrared analysis is provided in 6.7.

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4.4.1 Purity. Methods shall be selected from CGA G-4.3 except for grade F. The purity of grade F shall be determined by difference as follows:

$$\%O_2 = 100 - 10^4 \sum l$$

where $\sum l$ equals the sum of the water content, total hydrocarbons, nitrous oxide, carbon dioxide, carbon monoxide, and inert gases in ppm by volume.

4.4.2 Gaseous impurities. Methods shall be selected from those of CGA G-4.3.

4.4.3 Particulate content. A filter holder assembly (Pall Life Sciences part No. 2220) or equivalent, modified as shown in Figure 1, shall be attached to the withdrawal line of the vessel to be utilized to fill the tanks. A preweighed filter paper (47 mm glass fiber paper, type A/E or equivalent) shall be placed on top of another filter of the same kind. The filters shall then be placed on the porous filter support, which, in turn, shall be placed in the filter holder as shown in Figure 1. The male threads of the filter holder shall be wrapped with thin, nonadhesive-backed polytetrafluorethylene tape A-A-58092, or technical equivalent, to prevent galling of the threads. The holder shall be tightened by hand as tight as possible to prevent bypassing of the filter element. The discharge liquid from the filter housing shall be collected in a clean, uninsulated, ambient temperature vessel marked to indicate when 5 liters of liquid have been collected. The liquid flow shall be terminated when 5 liters of liquid have been collected. The filter holder shall be removed from the line and permitted to reach ambient temperature. The warmup to ambient temperature may be expedited by use of an oven or other heat source. Care shall be exercised to ensure that any airflow which enters the unit will be directed through the inlet of the assembly to prevent displacing and particles from the surface of the filter. Upon warmup, the other side of the holder shall be wiped with a clean cloth and the holder then disassembled. The filter paper shall be closely inspected. The test shall be repeated if evidence of either (a) the filter not being securely clamped by uniform depression of its edge; (b) the filter having been cut by the holder; or (c) when dirt particles are detected in the clamped area indicating bypassing had been encountered. The test shall also be repeated when either the bottom filter shows any discoloration or when leakage of liquid from the filter holder is detected. Upon completion of a valid test the filter shall be removed from the housing and weighed to the nearest 0.1 mg.

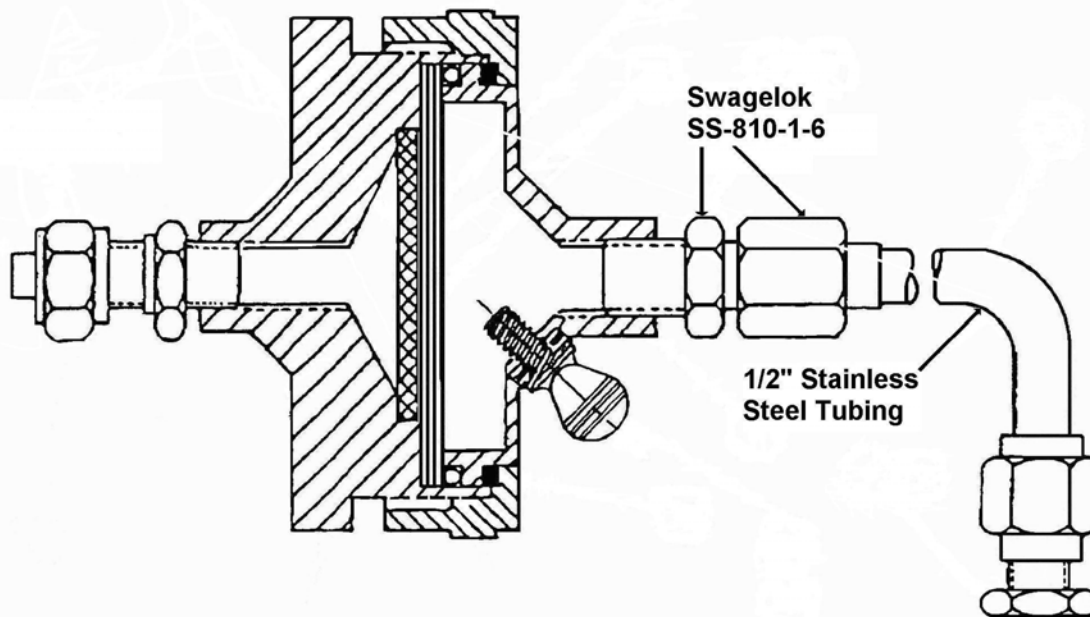


Figure 1. Filter Cryogenic Liquids

4.5 Containers of Type I oxygen.

4.5.1 Filling pressure. Containers shall be tested for proper filling pressure by attaching a calibrated Bourdon-tube gauge or equivalent to the valve outlet and by attaching either a thermocouple or thermometer to the container wall. The gauge shall have scale divisions not greater than 100 kPa (15 psi). If a thermometer is used, tape or putty shall be applied to the bulb to protect it from extraneous temperatures. Putty shall not be applied between the bulb and the container wall. The thermometer shall have scale divisions not greater than 1°C (2°F). The containers shall be stabilized to ambient temperature. The valve shall then be opened and the internal pressure observed on the gauge.

4.5.2 Leakage. Each Type I oxygen container shall be tested for leaks at the neck threads, stem packing, and safety device of the valve with leak-detection fluid. Valve seat leakage shall be tested by means of a tube from the valve outlet to a container of liquid.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

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6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The propellant covered by this specification is intended for use as follows.

- a. Grade A, type I – Purging and pressurization of propellant systems and rocket engines.
- b. Grade A, type II – Oxidizer.
- c. Grade B, type II - Oxidizer.
- d. Grade F, types I and II – Fuel cell grade that may be used for crew breathing in subsystems utilizing a common storage for both functions.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Type and grade of oxygen required (see 1.2).
- c. If required, the specific issue of individual documents referenced (see 2.2.1).
- d. When other limits or tests are required (see 3.1).
- e. When the particulate test is not required (see Table I).
- f. When a variation in the points of inspection is required (see 4.1).
- g. When a variation of the quality conformance tests to be performed on each sample is required (see 4.2.4).
- h. When a variation to the sampling method is required (see 4.2.4.2).
- i. When a variation to the continuous service option is required (see 4.2.6.1).
- j. When a variation to the 400 liter criteria for sampling is required (see 4.2.7).
- k. When a variation of the analytical procedures is required (see 4.4).
- l. Packaging requirements (see 5.1 and 6.3).

6.3 Packaging requirements. Guidance for cylinders may be found in the following documents.

- | | |
|-----------------|---|
| a. RR-C-901 | Cylinders, Compressed Gas: Seamless Shatterproof, High Pressure DOT 3AA Steel, and 3AL Aluminum |
| b. MIL-DTL-2/39 | Valve, Cylinder, Gas: Oxygen Outlet 540 |
| c. MIL-STD-101 | Color Code for Pipelines and for Compressed Gas Cylinders |

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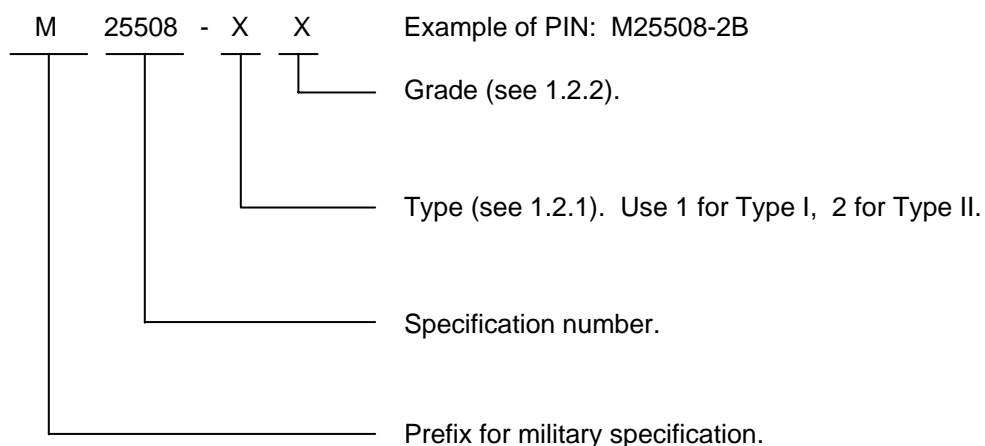
d. MIL-STD-1411 Inspection and Maintenance of Compressed Gas Cylinders

e. 49 CFR 171 – 199 Code of Federal Regulations

6.4 Definition.

6.4.1 Continuous service. Continuous service applies to continuous deliveries under Government contract of oxygen complying with the quality conformance tests specified herein.

6.5 Part or identifying number (PIN). The PIN's to be used for oxygen acquired to this specification are created as follows:



6.6 Subject term (key word) listing.

Aerospace
Breathing
Cryogenic
Cylinders
Fuel cell
Space vehicle

6.7 Infrared analysis. Procedures for calibration and analysis may be found in MIL-STD-1564, Procedure for Calibration and Analysis of Trace Contaminants in Aviator's Breathing Oxygen by Infrared Spectroscopy.

6.8 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

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Custodians:

Army – MI
Navy – AS
Air Force – 68
DLA – PS

Preparing activity:

Air Force – 68
(Project 9135-2005-007)

Review activities:

Air Force – 19
DLIS – LS

Civil Agencies:

NASA

Note: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information using the ASSIST Online database at <http://assist.daps.dla.mil>.